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GB 0754408 A US 4578037 A

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(54) Skydiving simulator

(57) A skydiving simulator is designed to be trailer-mounted so as to be readily transportable. A flight chamber 4 is mounted on a trailer alongside an engine-driven fan 12 rotatable about a generally horizontal axis, and a duct 14 leads air from the downstream side of the fan 12 to an aperture in the floor of the flight chamber 4. Flop diverters 20 deflect the air flow upwardly into the flight chamber 4 to support the weight of a human flier 6. Preferably a tubular baffle 4 induces a greater air flow around the edge of the flight chamber 4 than at its axial centre, to make it easier for a flier 6 to maintain a central position in the flight chamber.

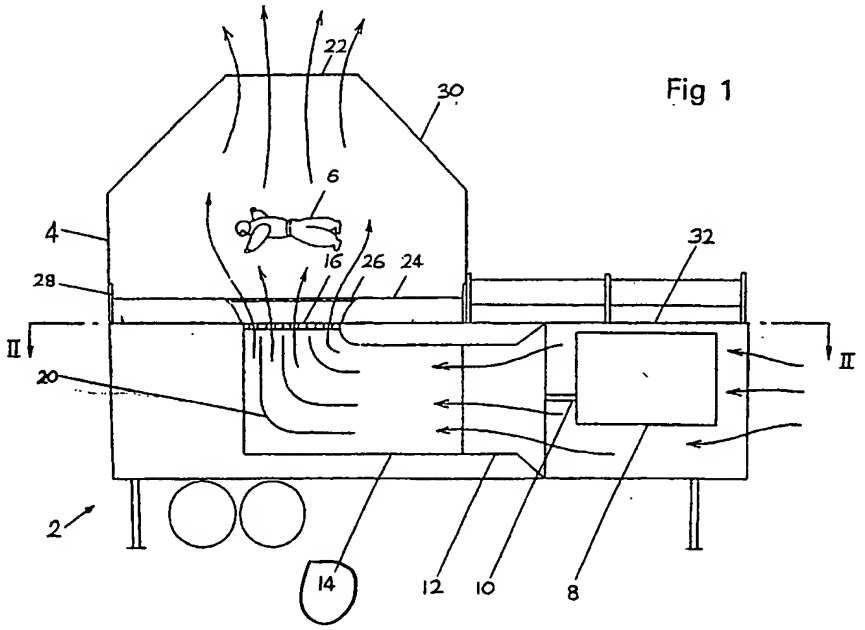

Fig 1

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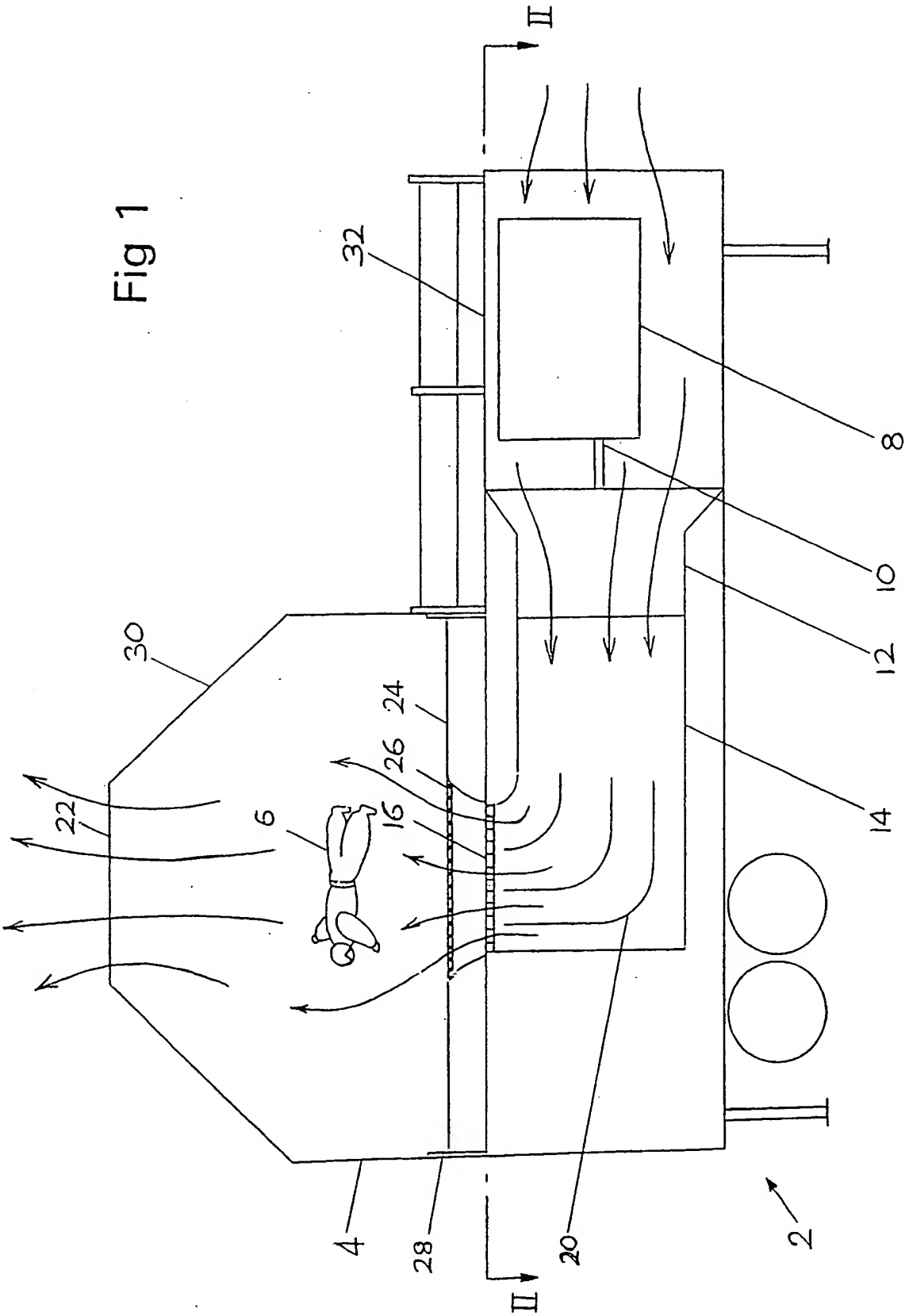
Fig 1



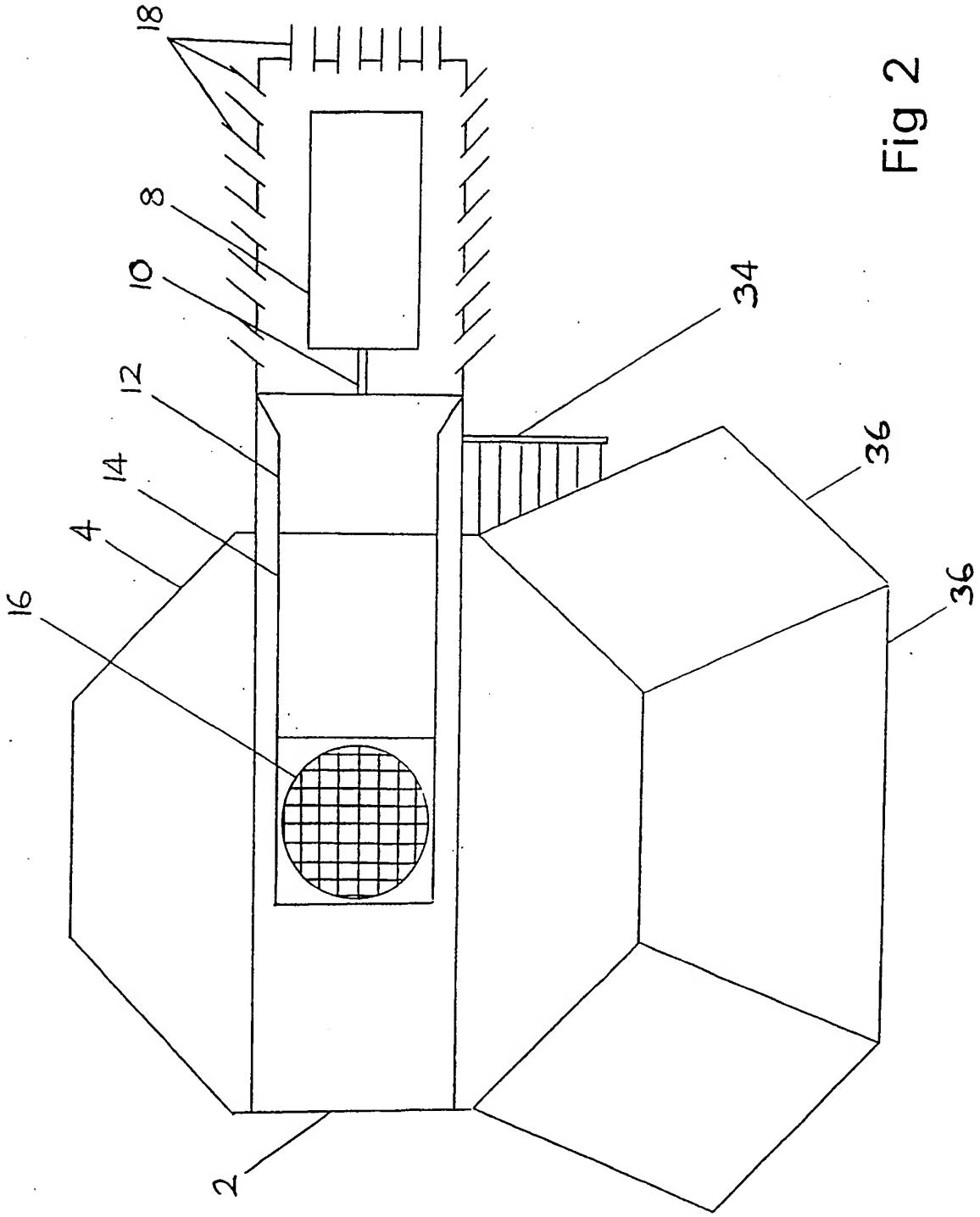


Fig 2

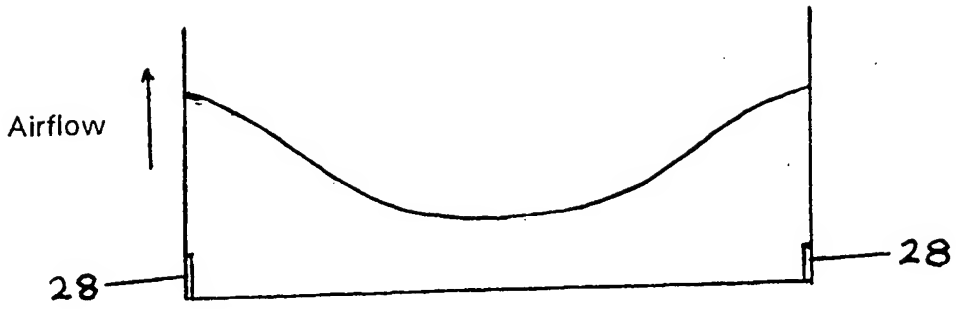


Fig 3

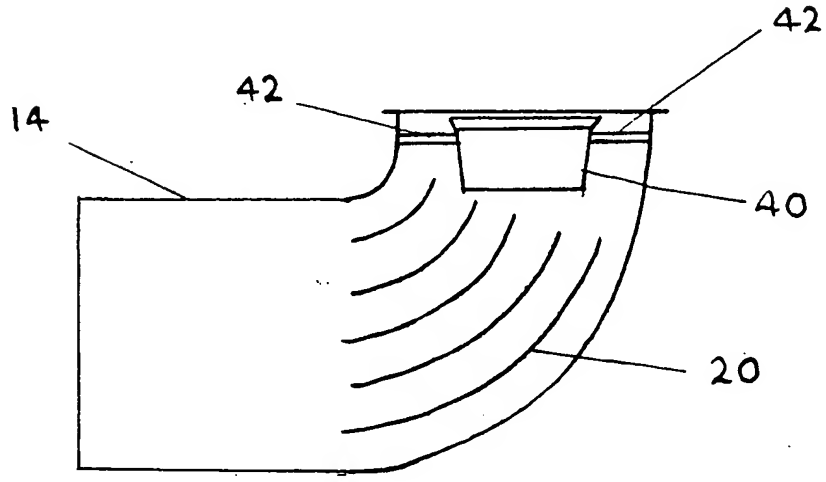


Fig 4

TITLE

Skydiving simulator

DESCRIPTION

Technical Field

The invention relates to apparatus for the re-creation of skydiving conditions by establishing an upward airflow capable of equalling the forces acting downwards upon a falling human body.

Background of the Invention

One example of apparatus for the simulation of skydiving is illustrated in Patent Application GB-A-2062557. The apparatus includes a sealed chamber with a suspended floor, beneath which are fans for creation of an upward airflow between diverging internal walls of the chamber. The air is recirculated to the fans around the outside of the internal walls. A major disadvantage of this apparatus is its requirement for a sealed chamber, to which entry is possible only via an airlock. A large and expensive permanent structure is required to house the chamber.

International Patent Application WO83/01380 discloses a skydiving simulator that does not employ a sealed chamber. It has a number of fans for blowing ambient air through ducts and into the base of the flying chamber. The air emerges from the top of the chamber to return to the atmosphere. The apparatus is intended to be easily dismantled for transport between different sites. However, construction of the apparatus remains quite complex and requires a solid base to which it can be bolted.

British Patent Application GB-A-2163106 illustrates

another skydiving simulator that is designed to be easily transportable. In this apparatus, a single large fan is located beneath the floor of the flying chamber to draw in ambient air and blow it up through the floor of the chamber to emerge through a net in the chamber roof. To reduce the emission of noise, a sound-damping wall surrounds the fan and the flight chamber.

Summary of the Invention

The invention provides a trailer-mounted skydiving simulator including a fan rotatable about a generally horizontal axis, an engine connected for rotation of the fan, a flight chamber with an aperture in the chamber floor and a vent in the chamber roof, an air inlet upstream of the fan and a duct for leading air from the downstream side of the fan to the aperture, to create an upward airflow in the flying chamber.

The provision of a horizontally-mounted fan allows the engine, fan and duct to be arranged serially, in a generally horizontal row, which makes it possible to mount the entire simulator economically on a trailer of normal road-going dimensions. The simulator can therefore be transported easily between sites and can be rapidly rigged and de-rigged because removal from the trailer is not necessary.

The invention allows a horizontal separation between the fan and the flight chamber, which facilitates sound-proofing of the fan without the need also to sound-proof the chamber. Because the fan is not located directly below the chamber, it is impossible for the flier or any object to fall into the fan if the floor of the chamber should fail, which is an advantage in terms of safety.

Preferably the connection between the engine and the fan is a fluid drive assembly. This has the advantage that,

if the engine should fail for any reason, the fan will reduce speed gradually so as not to cause damage to the fan and not to cause the flier to fall suddenly to the chamber floor.

In one embodiment of the invention, the simulator includes a flow straightener below the chamber aperture to concentrate airflow beneath the flier. The duct preferably contains flow diverters for directing air towards the aperture.

In a more preferred embodiment, the duct includes means for creating a flow gradient in the airflow, establishing a higher airflow around the edges of the flight chamber than at the centre. This has the effect of gently urging a flier towards the centre of the flight chamber and away from the edges. The equipment for creating such a flow gradient preferably comprises tubular baffle means below and coaxial with the aperture in the chamber floor, supported so that the airflow passes through and around the baffle means. The baffle means have an upwardly and outwardly divergent configuration, for example frustro-conical, to increase the airflow towards the edges of the flight chamber. Preferably the angle of divergence of the baffle means (for example the cone angle) is variable so that the airflow distribution or flow gradient can be varied in use on an empirical basis to establish the optimum safe flying conditions.

The chamber roof may be a net supported by arches and optionally includes a removable central portion. An area on top of the trailer, adjacent to the flying chamber, may be used as a viewing area and provide access to the chamber. Awnings around the trailer can form areas for activities such as briefing, changing and merchandising.

<u>The Drawings</u>

Figure 1 is a schematic cross-sectional side view of a simulator according to the invention.

Figure 2 is a schematic cross-secton on line II-II of Figure 1.

Figure 3 is a graph showing a preferred distribution of airflow velocities across the flight chamber in a modification of the simulator of Figures 1 and 2.

Figure 4 is a vertical axial section through a duct of the simulator of Figure 1, modified to create the airflow distribution of Figure 3.

Description of a Preferred Embodiments

Figures 1 and 2 show schematically a conventional road-going trailer 2 which supports a flight chamber 4. An upward airflow through the chamber 4 supports the weight of a human flier 6 to simulate skydiving conditions. The flier 6 is equipped with a light, semi-permeable flight suit to improve the flight characteristics.

The trailer 2 contains an engine 8 connected via a fluid drive assembly 10 to drive an axial flow fan, mounted for rotation about a horizontal axis. A duct 14 leads horizontally from the downstream side of the fan 12 and turns through 90° to connect with a grill 16 in the floor of the flight chamber 4.

During operation of the fan 12, atmospheric air is drawn through air inlets 18 (Figure 2). The inlets 18 are screened with filters to prevent the entry of particles and are constructed of sound-deadening materials.

The fan 12 propels the air from the air inlets 18 into the duct 14. Within the duct, flow diverters 20 change the direction of the air to direct it upwards through the grill 16 and into the flight chamber 4. At the top of the chamber 4, the air emerges to the atmosphere through the net from which the roof is constructed or through a

hole 22.

The grill 16 in the floor of the flight chamber 4 prevents the flier 6 or other objects from falling into the duct 14 and is preferably made of steel. The grill 16 is surrounded by air beds 24, which form a safe area on which the flier 6 can land without risk of injury. At their centre, the air beds 24 support an elastic mesh 26 above the grill 16. The mesh 26 keeps the flier 6 out of contact with the grill 16. To confine the flier 6 within the safe area, there are low walls 28 around the outside of the chamber 4. On top of these walls are erected arches to support nets forming a domed roof 30. The roof is typically 4 metres above the elastic mesh 26 but has a removable central panel to leave a hole 22, which allows experienced fliers to ascend to the upper limits of the air flow.

On one side of the flight chamber 4, the top of the trailer 2 provides a spectators' viewing platform 32 at the same level as the floor of the flight chamber 4. Access to the flight chamber 4 is provided from the viewing platform 32 but during operation a transparent plastic sheet protects spectators on the platform 32 from the residual airflow at the outer edge of the chamber 4. Steps 34 connect the viewing platform 32 to ground level.

Around other sides of the chamber, retractable awnings 36 form covered service areas that may be used for registration, briefing, training, equipping of fliers, the sale of merchandise or other activities.

As already stated, the simulator can be easily transported on the trailer 2. It is designed so that a crew of four people can rig and de-rig it in 180 minutes.

Figure 3 shows a preferred distribution of airflow

velocities across the flight chamber, obtained by modification of the simulator of Figures 1 and 2 as described below with reference to Figure 4. The abscissa of the distribution graph of Figure 3 represents the radial distance from the central axis of the flight chamber, and it will be seen that the airflow velocity is greater at the edges or periphery of the flight chamber than at its axial centre. Such an airflow distribution causes a flier who may otherwise be approaching an outer periphery of the chamber, over the air beds 24 rather than the grill 16, to be gently diverted back towards the axial centre of the flight chamber 4.

Apparatus to create the conditions of Figure 3 is substantially as described above with reference to Figures 1 and 2 except that an upwardly and outwardly divergent tubular baffle 40 is supported in the duct 14 immediately beneath the grill 16. If the duct 14 is circular in section, then the baffle 40 is preferably frustro-conical or substantially frustro-conical, with an upwardly and outwardly divergent tubular shape. Figure 4 shows the provision of adjustment rods 42 which serve to support the baffle 40 and to permit adjustment of the cone angle of the baffle 40. Adjustment of the cone angle permits an empirical adjustment of the flying conditions, to establish the conditions of optimum safety in use.

Beneath the baffle 40 of Figure 4 are flow diverters 20 similar to those of Figures 1 and 2. Elsewhere in Figure 4 the same reference numerals have been used to identify parts which are the same as those of Figures 1 and 2.

CLAIMS

1. A trailer-mounted skydiving simulator including a fan rotatable about a generally horizontal axis, an engine connected for rotation of the fan, a flight chamber with an aperture in the chamber floor and a vent in the chamber roof, an air inlet upstream of the fan and a duct for leading air from the downstream side of the fan to the aperture, to create an upward airflow in the flying chamber.

2. A skydiving simulator according to claim 1, wherein the engine, fan and duct are arranged on the trailer in a generally horizontal row.

3. A skydiving simulator according to claim 2, wherein there is a horizontal separation between the fan and the flight chamber, and the fan is sound-proofed to the benefit of anyone in the flight chamber.

4. A skydiving simulator according to any preceding claim, wherein the fan is connected to be driven by the motor through a fluid drive assembly which permits continued inertial rotation of the fan in the case of engine failure.

5. A skydiving simulator according to any preceding claim, wherein the duct includes flow diverter means to change the direction of the air from the fan and to direct it upwards through the aperture in the chamber floor and into the flight chamber.

6. A skydiving simulator according to claim 5, wherein the duct includes a flow straightener below the aperture in the chamber floor to concentrate airflow beneath the flier.

7. A skydiving simulator according to claim 5,

wherein the duct includes means for creating a flow gradient in the airflow, establishing a higher airflow around the periphery of the flight chamber than at the centre.

8. A skydiving simulator according to claim 7, wherein the means for creating the flow gradient comprises tubular baffle means below and coaxial with the aperture in the chamber flow, supported so that the airflow passes through and around the baffle means which have an upwardly and outwardly divergent configuration.

9. A skydiving simulator according to claim 8, wherein the baffle means is a frustro-conical or substantially frustro-conical member supported centrally below the aperture in the chamber floor.

10. A skydiving simulator according to claim 8 or claim 9, wherein the angle of divergence of the baffle means is variable.

11. A trailer-mounted skydiving simulator substantially as described herein with reference to Figures 1 and 2 of the drawings.

12. A trailer-mounted skydiving simulator substantially as described herein with reference to Figures 1 and 2 as modified by Figures 3 and 4 of the drawings.

The Patent Office

Application No: GB 9508802.7
Claims searched: 1 - 12

Examiner: C B VOSPER
Date of search: 11 July 1995

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.N): A6M (MBX,MCX,MXX) B7G

Int Cl (Ed.6): B64D 23/00, G01M 9/00

Other: ONLINE WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB0754408	DOMAN (fig.1 - shows horizontal axis fan producing vertical updraught)	1
X	US4578037	MACANGUS (figs. 3 and 4; col. 5 lines 25 to 27, - shows transportable simulator having horizontal axis fan producing vertical updraught)	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.